

**SUMMARY OF THE INDUSTRY/NASA/FAA
WORKSHOP ON PHILOSOPHY OF
AUTOMATION: PROMISES AND REALITIES**

**Susan D. Norman
NASA Ames Research Center**

ABSTRACT

Issues of flight deck automation are multi-faceted and complex. The rapid introduction of advanced computer based technology on to the flight deck of transport category aircraft has had considerable impact on both aircraft operations and the flight crew. As part of NASA's responsibility to facilitate an active exchange of ideas and information between members of the aviation community, an Industry/NASA/FAA workshop was conducted in August 1988. This paper summarized the major conclusions of that workshop.

One of the most important conclusions to emerge from the workshop was that the introduction of automation has clearly benefited aviation and has substantially improved the operational safety and efficiency of our air transport system. For example, one carrier stated that they have been flying the Boeing 767 (one of the first aircraft to employ substantial automation) since 1982, and they have never had an accident or incident resulting in damage to the aircraft.

Notwithstanding its benefits, many issues associated with the design, certification, and operation of automated aircraft were identified. For example two key conceptual issues were the need for the crew to have a thorough understanding of the system and the importance of defining the pilot's role. With respect to certification, a fundamental issue is the lack of comprehensive human factors requirements in the current regulations. Operational considerations, which have been a factor in incidents involving automation, were also cited.

Copies of the final report, *NASA Conference Publication 10036*, may be obtained by requesting a copy from

Susan Norman
Aerospace Human Factors Division
NASA Ames Research Center
Moffett Field, California 94035

AUTOMATION IS A CLEAR BENEFIT

DESIGN PHILOSOPHIES

(From Boeing Commercial Airplane Company)

Effective Systems Design

- 1) Simplicity**
- 2) Redundancy**
- 3) Automation**

OPERATIONAL LESSONS LEARNED

TRAINING/ OPERATIONAL PROCEDURES

- Crews need to understand HOW the system works

MODE MISAPPLICATION

- Crew assumption that the aircraft is operating in one mode when it is actually in another

OPERATIONAL CRUTCHES

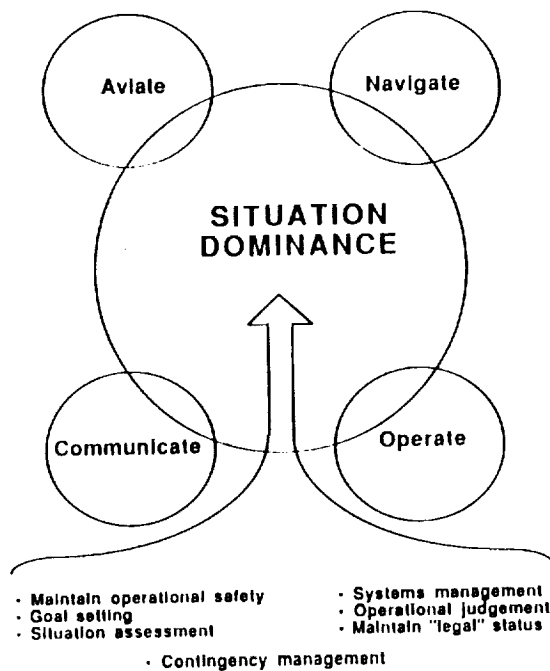
- Changing an operational procedure to get around an improper design

SOFT FAILURES

- When an automated system is not indicating a failure yet something is clearly wrong

ISSUES IN AUTOMATION

DESIGN/ ROLE of the PILOT



TECHNICAL SUMMARY

1) UNDERSTANDING NORMAL versus IRREGULAR OPERATIONS

**Irregular operations are "UNANTICIPATED"
deviations from intended flight operations**

2) DEFINE the ROLE of the PILOT

Distinguish between the Pilot's GOAL and ROLE

Develop a Philosophy of Automation

3) AIR-GROUND COMMUNICATION INTERFACE

A SYSTEMS Perspective Is needed

4) CERTIFICATION of AUTOMATED SYSTEMS

Need to develop HUMAN FACTORS criteria/guidelines